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NOTES ON NORTH AMERICAN HYPOCREALES—IV. ASCHERSONIA AND HYPOCRELLA

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(WITH PLATE 6)

The perfect stage of *Aschersonia turbinata* was recently described by Dr. Roland Thaxter,¹ but the generic position of the fungus was left an open question. In that paper Dr. Thaxter states that so far as he knows no ascosporic condition has previously been observed in any of the group (*Aschersoniae*). After a study of the tropical material and literature at hand, the writer is convinced that this apparent failure to detect the perfect stage of this genus is due not so much to its absence as to the fact that whenever the perfect stage is found, the fungus is at once and quite properly referred to some other genus, to *Hypocrea* by early writers and to *Hypocrella* by more recent ones. In fact there seems to be little more reason for describing the perfect stage of this fungus under the name of *Aschersonia* than for describing a *Cordyceps* under the name of *Isaria*, although the *Isaria* stage is usually mentioned when it is known. That the connection between *Aschersonia* and *Hypocrella* has been observed and noted in literature will be pointed out later on.

The attention of the writer was first called to this matter several years ago while attempting to determine a collection of tropical fungi. One specimen collected by A. A. Heller in Porto Rico in 1900 was found to have linear spores and was labeled *Hypocrella* sp. and filed away under the new and noteworthy species of Hypocreales, since it had been overlooked in the work on the Hypocreales of North America. The same species was collected by Dr. B. Fink in Porto Rico in 1915 and doubtfully referred to *Hypocrella flicina* Rehm, although the stroma is white instead of

¹ Bot. Gaz. 57: 308-313. 1914.

black as described by Rehm. The blackening might easily be due to age and weathering. Many other tropical specimens have been studied which are apparently the same but in which the perfect stage is lacking. These have been referred to *Aschersonia*.

Recently, since taking up a study of Porto Rican fungi, these facts have again forced themselves to the front and more attention has been given to the matter. In looking over the literature of the subject I find that *Hypocrea phyllogena* Mont.² which was doubtfully recorded for North America in *North American Flora* has every appearance of being the perfect stage of an *Aschersonia* as recently described by Thaxter. The capitate apex of the ascus which is characteristic of the perfect stage of *Aschersonia* is especially evident in Montagne's illustration. When several years after the description of *Hypocrea phyllogena*, Montagne founded the genus *Aschersonia*,³ it was said to be related to *Hypocrea* (which at that time included *Hypocrella*) and was described as representing the *Hypocreae* in which the asci are wanting, or what is now known as the pycnidial stage of the *Hypocreae*. It is even not unlikely that the type of *Aschersonia*, *Aschersonia tahitensis* Mont., is the pycnidial stage of his own *Hypocrea phyllogena*.

From the above facts and the observations which have been made on the tropical specimens in the collections of the garden, it seems evident that the genus *Aschersonia* represents the pycnidial form of *Hypocrella* and that *Hypocrella phyllogena* (Mont.) Speg. which was described eight years before the genus *Aschersonia* was proposed really represented the perfect stage of an *Aschersonia* as now known. *Aschersonia* would then occupy the same relation to *Hypocrella* as *Isaria* to *Cordyceps*.

In looking over the literature of the subject I find that this connection has not been entirely overlooked by previous authors. In 1900, Raciborski⁴ gave a detailed description of *Hypocrella discoidea* (Berk. & Br.) Sacc. (the type of the genus *Hypocrella*). This was reported by him on *Elettaria* and *Amomum*. In a note

² Ann. Sci. Nat. II. 13: 340. 1840.

³ Ann. Sci. Nat. III. 10: 121. 1848.

⁴ Parasit. Algen und Pilze Java's 3: 22-23. 1900.

on this species he refers to a snow-white, otherwise similar species of *Hypocrella* (?) which grows abundantly on *Elettaria* stems. In this form, however, he says that only the conidial form (*Aschersonia*) has been found by him. In 1909 von Höhnelt⁵ described *Hypocrella cretacea* and calls attention to the fact that this probably represents the perfect stage of the *Aschersonia* mentioned by Raciborski in the article referred to above. It should not be overlooked that Raciborski has noted the similarity in habitat and all external characters except color to *Hypocrella discoidea*, the type of the genus *Hypocrella* so that we at least have reason to suspect that the genus *Hypocrella* itself was founded on the perfect stage of an *Aschersonia*. *Hypocrella cretacea* von Höhnelt may be found to be identical with *Hypocrella discoidea* (Berk. & Br.) Sacc. as described by Raciborski.

In the absence of suitable material it is difficult to determine the identity of our own species with any degree of certainty. The one collected by Heller agrees well with *Hypocrella cretacea* von Höhnelt, as collected by von Höhnelt and distributed by Rehm in his *Ascomycetes* 1870. As already mentioned this may prove to be identical with *Hypocrella discoidea* (Berk. & Br.) Sacc. to which it is said to be similar, although Raciborski claims that the latter species differs from other species of *Hypocrella* in the fact that the spores do not break up into segments. This apparent difference may be due to the age of the specimens and may not prove to be of specific value although considerable importance has been attached to it. Just how *Hypocrella discoidea* differs from *Hypocrella phyllogena* (Mont.) Speg. it is impossible to know in the absence of authentic material of the latter species.

It is difficult to find conidia in the mature stromata. In most specimens, however, the younger stromata show an abundance of conidia. As these are usually found loose in large numbers, their method of attachment is not easily detected. The individual conidia appear to be rather small, ellipsoid bodies which taper into a bristle-like apiculus at each end. Although they are guttulate and granular and sometimes pseudoseptate, no true septum could be detected. In the absence of asci, the presence of this par-

⁵ Sitz.-ber. Akad. Wissen. Wien. 118: 311. 1909.

ticular type of conidia together with the white discoid stromata are regarded as of specific importance, although the conidia could not be found in the authentic specimen of *Hypocrella cretacea* examined, all of the stromata in which were ascigerous.

In looking over our collections, nine specimens collected by H. H. Whetzel and E. W. Olive (Nos. 716-724 inclusive) are found to represent the conidial stage of what is here referred to as *Hypocrella cretacea*. All so far as examined show the typical stromata and conidia but none so far as discovered contain asci. All are reported on some species of *Adiantum*. The same form was collected by F. L. Stevens on fern. The specimen collected by B. Fink which shows both asci and conidia has already been mentioned. An abundance of the conidial stage of the fungus was collected by N. L. Britton, J. F. Cowell and Stewardson Brown (No. 5250), also, on some fern. While the species appears to be more common on ferns, what appears to be the same species was collected by L. M. Underwood and F. S. Earle in Cuba on the leaves of some flowering plant. Since the fungus is entomogenous, it would naturally be dependent on the insect host rather than the plant host. The latter however might be restricted in its occurrence to certain plant hosts. This is one of the questions which needs careful investigation.

If our conclusions are right regarding the connection of *Aschersonia* and *Hypocrella*, the form for which Thaxter recently described the ascigerous stage, assuming that this is specifically distinct, as it appears to be, would be a *Hypocrella*. It should then become ***Hypocrella turbinata*** (Berk.) comb. nov.

Another very interesting form with its ascigerous stage has been encountered in our collections distributed by Sydow in *Fungi Exotici Exsiccati* 84, under the name of *Hypocrella salaccensis* (Racib.) Petch (in litt.). The specimen examined was collected in the Philipines by P. W. Graff. This species was originally described by Raciborski under the name of *Barya salaccensis*.⁶ In this species, according to its author, the spindle-shaped conidia are formed after the fashion of an *Aschersonia*. These are followed by the perithecia which are so prominent that they appear

⁶ Bull. Acad. Sci. Cracovie 1906: 909.

almost superficial. The capitate ascus is a very conspicuous character in this species and the segmentation of the spores is much more conspicuous than in the previous species.

Another species with its perfect stage was collected by J. R. Johnston and J. A. Stevenson at Naguabo, Porto Rico, March 9, 1914, No. 1640. This species is said by the collectors to occur on white fly and was collected on the leaves of *Bignonia unguis* L. In this species, which will be here designated as **Hypocrella disjuncta** sp. nov., the stromata are tuberculate and slightly constricted at the base. They are perched on the rather large ellipsoid scale so that the insect itself is distinctly visible, serving as a substratum for the stroma. The stroma becomes dull-grayish when mature. The capitate apex of the ascus is small since the ascus itself is constricted at the apex and strongly swollen near the center. While the spores are evidently filiform when young, they very soon break up into their component parts, which become so disjuncted and disheveled that the older ascus appears to be polysporous with little hint of their real filiform character. This is very different from *Hypocrella cretacea* in which the filiform spores may be easily seen protruding from the broken ascus.

Still another Porto Rican species was collected by H. H. Whetzel and E. W. Olive at Maricao on the leaves of *Inga laurina* Willd., No. 734. This was labeled *Aschersonia* sp. Later, on a more careful examination, some of the stromata were found to contain asci and the species was referred to *Hypocrella guaranitica* Speg., since it seems to agree well with that species as distributed by Balansa in *Plantes du Paraguay*, No. 3146. The stromata in this species are tubercular, rather conspicuous and become black at maturity. The species grows on a circular scale which is almost completely obscured at maturity.

Hypocrella Tamoneae Earle, which was published by the writer in the "Hypocreales of North America," was again collected by H. H. Whetzel and E. W. Olive at Maricao, No. 472. This was said by the collectors to occur on scale insects (?). While this species has all of the characters of a *Hypocrella* its entomogenous character is much less evident than in the other species studied, although as noted above its entomogenous character was sus-

pected by the collectors before its identity was known. The stromata seems to be more firmly attached to the leaf than those of the other species studied. It appears to occur on some kind of an insect spot.

In 1891, Patouillard⁷ called attention to the fact that *Hypocrea viridans* Berk. & Curt. is an *Aschersonia*. This species was included in *North American Flora* as a doubtful species. This again emphasizes the similarity between *Hypocrea* (then including *Hypocrella*) and *Aschersonia*.

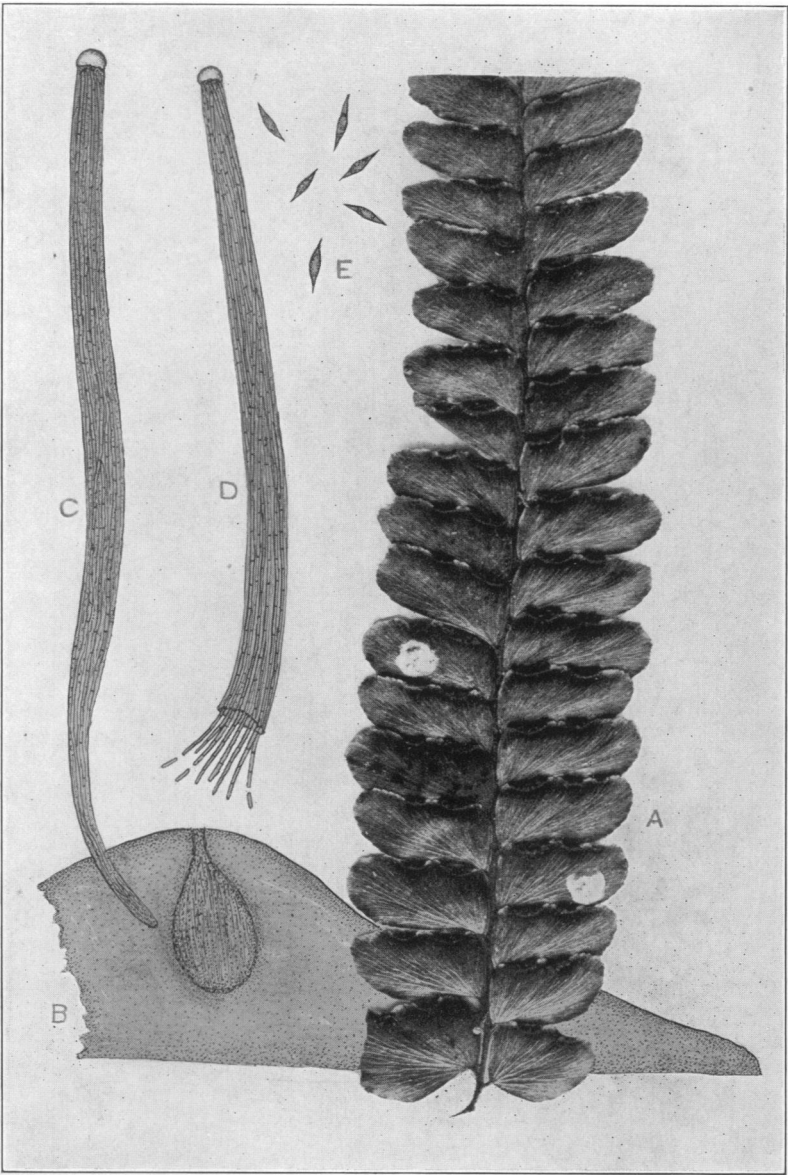
Since most if not all of the species of *Hypocrella* are entomogenous it may be that the various species of the genus will prove to be of economic importance in combating harmful insects, since two species of *Aschersonia* have already been employed in Florida for this purpose. A critical study of the species of *Hypocrella* in the tropics together with the insects which they parasitize might reveal new insect enemies which could be used for this purpose in our own states. This would at least furnish an interesting field for investigation.

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EXPLANATION OF PLATE 6

Hypocrella cretacea.—*A*, photograph of fern leaf with two stromata; *B*, diagram section of stromata showing perithecium; *C*, ascus with spores; *D*, broken ascus with protruding spores; *E*, conidia; *C-E*, drawn with camera lucida.

⁷ Bull. Soc. Myc. Fr. 7: 48. 1891.



HYPOCRELLA CRETACEA VON HÖHNEL